

Amendments to the Specification

At page 1, immediately following the title, please insert the following:

This is the U.S. national phase of International Application No. PCT/GB2004/005392 filed December 20, 2004, the entire disclosure of which is hereby incorporated herein by reference.

Please amend the paragraph beginning at page 1, line 35 as follows:

Accordingly, considerable effort has been directed towards producing luminescence from triplet excitons (phosphorescence) by utilising utilizing spin-orbit coupling effects in metal complexes that enable triplet excitons to undergo radiative decay. The metal complex is doped into a host material from which it receives charge and / or triplet excitons. Examples of complexes investigated for this purpose include lanthanide metal chelates [Adv. Mater., 1999, 11, 1349], a platinum (II) porphyrin [Nature (London), 1998, 395, 151] and tris(phenylpyridine) iridium (III) (hereinafter "Ir(ppy)₃") [Appl. Phys. Lett., 1999, 75, 4; Appl. Phys. Lett., 2000, 77, 904]. Fuller reviews of such complexes may be found in Pure Appl. Chem., 1999, 71, 2095, Materials Science & Engineering, R: Reports (2002), R39(5-6), 143-222 and Polymeric Materials Science and Engineering (2000), 83, 202-203.

Please amend the paragraph beginning at page 2, line 8 as follows:

Prior art phosphorescent OLEDs often comprise charge transporting and / or charge blocking layers used in conjunction with the electroluminescent layer in order to maximise maximize device efficiency. The charge transporting / blocking layers and the electroluminescent layers are typically formed by vacuum evaporation of the appropriate materials in sequence

Please amend the paragraph beginning at page 3, line 2, as follows:

~~It is therefore an object of the invention to provide a method of forming a phosphorescent OLED by solution deposition of a plurality of layers that is not~~

~~constrained by the nature of the material being used. It is a further object of the invention to provide a phosphorescent OLED having improved device performance.~~

Please amend the paragraph beginning at page 4, line 7, as follows:

Following the aforementioned treatment, it may be possible to solubilise solubilize the charge transporting layer under forcing conditions (e.g. by exposure to the solvent at elevated temperature and/or immersion in the solvent over a prolonged period), particularly in the case where the charge transporting layer is substantially free of cross-linkable groups. In this case, the present inventors have found that at least part of the charge transporting layer remains intact under conditions typically employed for deposition of the electroluminescent layer, although an upper part of the charge transporting layer may dissolve upon contact with the solvent. The term "insoluble" should be construed accordingly.

Please amend the paragraph beginning at page 4, line 16, as follows:

Partial dissolution of the charge transporting layer may be desirable in order to form a mixed region between the charge transporting layer and the electroluminescent layer. The extent of this partial dissolution may be controlled by appropriate selection of conditions for insolubilisation insolubilization of the charge transporting layer. Thus use of cross-linking groups will typically result in insolubilisation insolubilization of the whole of the charge transporting layer as deposited. Alternatively, selection of time and temperature for heat treatment of a charge transporting layer that is substantially free of cross-linkable groups may be used to control the extent of insolubilisation insolubilization of the charge transporting layer as deposited.

Please amend the paragraph beginning at page 5, line 10, as follows:

Preferably, Ar³ is phenyl. Ar³ may be substituted or unsubstituted; preferably Ar³ is substituted with a solubilising solubilizing group, more preferably optionally substituted C₁₋₂₀ alkyl or C₁₋₂₀ alkoxy.

Please amend the paragraph beginning at page 5, line 25, as follows:

In a-~~second~~ another aspect, the invention provides an organic light emitting diode obtainable by the method according to the first aspect of the invention.

Please amend the paragraph beginning at page 8, line 17, as follows:

Although low triplet energy level charge transporting or injecting materials may be undesirable if placed adjacent to the electroluminescent layer, such materials may serve to ~~optimise~~ optimize device performance if they are placed remote from the electroluminescent.

Please amend the paragraph beginning at page 8, line 35, as follows:

Preferred charge transporting materials, host materials and electroluminescent materials for the third, ~~fourth~~ fourth, fifth and sixth aspects of the invention are as described with respect to the first aspect of the invention.

Please amend the paragraph beginning at page 9, line 4, as follows:

The ~~present~~ invention will now be described in further detail, by way of example only, with reference to the accompanying drawings in which:

Please amend the paragraph beginning at page 9, line 28, as follows:

Cathode 6 is selected in order that electrons are efficiently injected into the device and as such may comprise a single conductive material such as a layer of ~~aluminium~~ aluminum. Alternatively, it may comprise a plurality of metals, for example a bilayer of calcium and ~~aluminium~~ aluminum as disclosed in WO 98/10621. A thin layer of dielectric material such as lithium fluoride may be provided between the electroluminescent layer 5 and the cathode 6 to assist electron injection as disclosed in, for example, WO 00/48258.

Please amend the paragraph beginning at page 11, line 17, as follows:

These polymers may be homopolymers or copolymers. Where they are copolymers, suitable co-repeat units are optionally substituted arylene such as fluorenes as disclosed in Adv. Mater. 2000 12(23) 1737-1750, particularly 2,7-linked 9,9-dialkyl fluorene, 9,9-diaryl fluorene or 9-alkyl-9-aryl fluorene; a spirofluorene such as 2,7-linked spirobifluorene as disclosed in EP 0707020; an indenofluorene such as a 2,7-linked indenofluorene; or a phenylene such as alkyl or alkoxy substituted 1,4-phenylene. Each of these repeat units may be substituted. These copolymers are particularly advantageous because they have good film forming properties and may be readily formed by Suzuki or Yamamoto polymerisation polymerization which enables a high degree of control over the regioregularity of the resultant polymer.

Please amend the paragraph beginning at page 14, line 9, as follows:

The hole transporting layer may be rendered insoluble even if no cross-linkable groups are present within it by an appropriate insolubilisation insolubilization treatment. The hole transporting layer is then stable to solution deposition of the electroluminescent layer. The present inventors have found that this insoluble layer forms (a) regardless of whether a PEDT/PSS layer is used or not (although presence of PEDT/PSS is preferred) and (b) in air or in a nitrogen only environment. However, the present inventors have found that it is necessary to subject the hole transporting layer to an insolubilising insolubilizing treatment in order to maximise maximize device performance, and in particular to minimise minimize mixing of the second layer with the first layer by increasing the insolubility of the first layer. Without wishing to be bound by any theory, possible mechanisms for loss of solubility of the hole transporting layer upon insolubilisation insolubilization treatment when no cross-linkable groups are present include formation of a relatively solvent impermeable surface or an adhesion to the surface that the hole transporting layer following elimination of solvent from a solution deposited hole transporting layer.

Please amend the paragraph beginning at page 17, line 8, as follows:

Suitable coordinating groups for the f-block metals include oxygen or nitrogen donor systems such as carboxylic acids, 1,3-diketonates, hydroxy carboxylic acids, Schiff bases including acyl phenols and iminoacyl groups. As is known, luminescent lanthanide metal complexes require sensitizing group(s) which have the triplet excited energy level higher than the first excited state of the metal ion. Emission is from an f-f transition of the metal and so the emission ~~colour~~ color is determined by the choice of the metal. The sharp emission is generally narrow, resulting in a pure ~~colour~~ color emission useful for display applications.

Please amend the paragraph beginning at page 18, line 2, as follows:

One or both of Ar¹⁰ and Ar¹¹ may carry one or more substituents. Particularly preferred substituents include fluorine or trifluoromethyl which may be used to blue-shift the emission of the complex as disclosed in WO 02/45466, WO 02/44189, US 2002-117662 and US 2002-182441; alkyl or alkoxy groups as disclosed in JP 2002-324679; carbazole which may be used to assist hole transport to the complex when used as an emissive material as disclosed in WO 02/81448; bromine, chlorine or iodine which can serve to functionalise functionalize the ligand for attachment of further groups as disclosed in WO 02/68435 and EP 1245659; and dendrons which may be used to obtain or enhance solution processability of the metal complex as disclosed in WO 02/66552.

Please amend the paragraph beginning at page 18, line 36, as follows:

Suitable solution processing techniques for deposition of the hole transporting layer and the electroluminescent layer include spin-coating, inkjet printing as disclosed in EP 0880303, laser transfer as described in EP 0851714, flexographic printing, screen printing and doctor blade coating. Provision of such solvabilising solubilizing groups as described above may be particularly advantageous for rendering the phosphorescent material more suitable for solution processing techniques such as inkjet printing.

Please amend the paragraph beginning at page 20, line 34, as follows:

6) Depositing over the electroluminescent layer a cathode comprising a first layer of lithium fluoride (4 nm), a second layer calcium (10 nm) and a capping layer of aluminium aluminum (>200 nm) as described in WO 00/48258.

Please amend the paragraph beginning at page 21, line 18, as follows:

- a host polymer having the composition 70 % 9,9-dioctylfluorene-2,7-diyl, 10 % 9,9-diphenylfluorene-2,7-diyl, 10 % "TFB" repeat unit and 10 % "PFB" repeat unit as disclosed in WO 02/92723 (TFB and PFB repeat units are illustrated below). The polymer was prepared by Suzuki polymerisation polymerization as disclosed in, for example, WO 00/53656.

Please amend the paragraph beginning at page 23, line 31, as follows:

Although the present invention has been described in terms of specific exemplary embodiments, it will be appreciated that various modifications, alterations and / or combinations of features disclosed herein will be apparent to those skilled in the art without departing from the spirit and scope of the invention as set forth in the following claims.